INTRODUCTION

As a part of a program to evaluate and document the potentiometric surface (water level) of the major aquifers in Mississippi, the U.S. Geological Survey, in cooperation with the Mississippi Department of Environmental Quality, Office of Land and Water Resources, measures water levels at about 5-year intervals in wells completed in the Ripley and Paleozoic aquifers in northeastern Mississippi. This potentiometric-surface map report, the first combined report in the series for the Ripley and the Paleozoic aquifers, is based on water-level data collected in 35 wells in the Ripley aquifers and 12 wells in the Paleozoic aquifer during August through December 1987. The study area for the Ripley aquifers includes 12 counties -6 counties where water-level measurements were made and 6 adjacent counties included to show the areas of outcrop and downdip limits of freshwater. Figure 1 shows these 12 counties plus 6 additional counties to help orient the reader. The study area for the Paleozoic aquifer includes Alcorn, Prentiss, and Tishomingo Counties. Two previously published potentiometric-surface maps for the Ripley aquifers were based on water-level measurements made during October and November 1978 (Wasson, 1980) and during November and December 1982 (Darden, 1985). Two previously published potentiometric-surface maps for the Paleozoic aquifer were based on water-level measurements made during October and November 1978 (Wasson, 1979) and during November and December 1982 (Darden, 1984). Although potentiometric-surface contours shown in this report were based on water-level measurements made during a 5-month period in 1987 rather than during a 2-month period as in 1978 and 1982, the contours are believed representative of the potentiometric surface at a point in time because seasonal water-level changes were small (less than 5 feet) relative to long-term

HYDROGEOLOGY Ripley Aquifers

The Ripley aquifers in northeastern Mississippi consist of the water-bearing units of the Ripley Formation, which is in the Selma Group of Late Cretaceous age. The Ripley Formation consists of sediments ranging from chalky sand and clay in the south to thick beds of sand, clay, sandstone, marl, and limestone in the north. The formation is undifferentiated in the southern part of the study area, but in the northern part near the Mississippi-Tennessee boundary, it encompasses units that vary in hydrologic characteristics (Boswell, 1963). These units, in descending order, are the Chiwapa Sandstone Member, McNairy Sand Member, Coon Creek Tongue, and the transitional clay (Mellen, 1958). The Ripley Formation overlies the Bluffport Marl Member of the Demopolis Chalk in eastern Mississippi and western Alabama and lies directly upon the Demopolis Chalk in northern Mississippi (Boswell, 1963). The Prairie Bluff Chalk overlies the Ripley Formation in the southern part of the study area and the Owl Creek Formation overlies it in the northern part. The Ripley Formation crops out in Alcorn, Tippah, Prentiss, Union, Pontotoc, Chickasaw, and Clay Counties (fig. 1).

In the study area, the sands of the Chiwapa Sandstone Member and the McNairy Sand Member are two important aquifers in the Ripley Formation; collectively, these are referred to as the Ripley aquifers. The Chiwapa Sandstone Member, named and described by Mellen (1958), is an excellent source of water in Pontotoc County, northwestern Chickasaw County, northeastern Lafayette County, and part of western Union County. In Pontotoc and Chickasaw Counties, the Chiwapa Sandstone Member forms the upper part of the Ripley Formation (Mellen, 1958). The Chiwapa thins northward and pinches out in Tippah County (Sohl, 1960). The McNairy Sand Member, a primary aquifer in northeastern Mississippi, extends southward from Tennessee and crops out in Union and Tippah Counties. In central Union County, the McNairy Sand Member is relatively thin. Other separable units in the lower part of the Ripley Formation include the Coon Creek Tongue and the transitional clay, a zone of clay lying beneath the Coon Creek Tongue and above the Demopolis Chalk. The Coon Creek Tongue is not an important part of the Ripley aquifers but is the source of water for a few shallow wells in the outcrop area (Boswell, 1963). Water in the Ripley aquifers moves generally from the outcrop areas to the west and southwest except where potentiometric surfaces are affected by drainage from tributaries to major streams. The southern limit of freshwater in the Ripley aquifers extends into Webster

Paleozoic Aquifer

The Paleozoic aquifer in northeastern Mississippi, which consists of rocks of Paleozoic age, is overlain by aquifers in formations of Cretaceous age: the Coffee Sand, Gordo, Eutaw, and McShan Formations. In some parts of the study area, Cretaceous aquifers are in hydraulic connection with the Paleozoic aquifer. The Paleozoic aquifer consists of sedimentary rocks, including chert, sandstone, shale, and limestone (Boswell and others, 1965). Highly weathered chert zones provide most of the ground water to wells completed in this aquifer. Paleozoic rocks crop out in northeastern Mississippi primarily along the eastern edge of Tishomingo County (fig. 2) and dip southwestward. Commonly, where the rocks of Paleozoic age are exposed, as in northern Tishomingo County, precipitation on the outcrop areas is probably the major source of recharge to the Paleozoic aquifer. In Alcorn County, where the Paleozoic aquifer subcrops beneath water-bearing sediments of Cretaceous age, downward leakage of water is the most likely source of most recharge to the Paleozoic aquifer (J.H. Hoffman, Mississippi Department of Environmental Quality, Office of Land and Water Resources, written commun.,

GROUND-WATER USE

In parts of northeastern Mississippi, the Ripley aquifers, particularly the McNairy Sand and the Chiwapa Sandstone Members (the major water-bearing units of the Ripley Formation), are sources of freshwater (water with dissolved-solids concentrations less than 1,000 milligrams per liter) for several small municipal wells, some small industrial wells, and many domestic and farm wells. The McNairy Sand Member in Tippah and Benton Counties and the Chiwapa Sandstone Member in Union and Pontotoc Counties yield a soft, sodium bicarbonate type water except in and near the outcrop areas. In and near the outcrop areas, the Ripley aquifers yield a hard, calcium-magnesium bicarbonate type water. Because of the variety of sediments that are present in the formations, the Ripley aquifers yield water that is variable in chemical quality and pretreatment may be necessary to make the water suitable for some

In 1985, water use from the Ripley aquifers was about 1.18 million gallons per day, which was less than 1 percent of the total ground water used in the State. Withdrawals from the Ripley aquifers totaled about 0.41 million gallons per day in Tippah County, 0.30 million gallons per day in Marshall County, 0.16 million gallons per day in Union County, 0.11 million gallons per day in Pontotoc County, 0.10 million gallons per day in Benton County, 0.06 million gallons per day in Chickasaw County, and about 0.04 million gallons per day in Lafayette County (data from the U.S. Geological Survey National Water Data Storage and Retrieval System). The largest withdrawals from the Ripley aquifers in Mississippi occur at or near Ripley (Tippah County) and Byhalia (Marshall County). The Ripley aquifers are the chief sources of water supply for the towns of Ashland, Byhalia, Hickory Flat, and Myrtle, Mississippi.

Paleozoic Aquifer

The Paleozoic aquifer is a source of freshwater for public, industrial, and shallow domestic supplies in northeastern Mississippi. According to Wasson (1986), most of the freshwater known to occur in the study area in rocks of Paleozoic age is in the upper 100 feet of the highly weathered chert zones. Although wells in some of the overlying aquifers generally yield ample groundwater supplies, the Paleozoic aquifer is used locally in Tishomingo County and in parts of other adjacent counties where iron concentrations in water from the Cretaceous aquifers have increased. In Alcorn County, the Coffee Sand aguifer was the principal source of water in the deeper Paleozoic aquifer was of generally more acceptable quality (Wasson and Tharpe, 1975).

estimated to be 4.4 million gallons per day. Withdrawals from this aquifer accounted for less than 1 percent of the total ground water used in the State. Withdrawals from the aquifer were about 4.3 million gallons per day in Alcorn County and about 0.1 million gallons per day in Tishomingo County (data from the U.S. Geological Survey National Water Data Storage and Retrieval System). The largest withdrawals from the Paleozoic aquifer in Mississippi occur in the Corinth area in Alcorn

GROUND-WATER LEVELS

The potentiometric surfaces of the Ripley and the Paleozoic aquifers are shown in figures 1 and 2. The altitudes of the potentiometric surfaces generally decrease from the outcrop areas to the west and

study area has only a local effect on water levels, water levels in many wells completed in these aquifers may show an upward or downward trend as a result of variations in precipitation and recharge. For example, water levels in well K37 in Chickasaw County had a small (less than 1 foot per year) upward trend between 1978 and 1987 (fig. 3). During the same period, water levels in well B8 in Tippah County had a small net change.

Paleozoic aquifer

Two small cones of depression exist in the potentiometric surface of the Paleozoic aquifer in Alcorn County-one near Corinth and another about 10 miles southwest of Corinth. These cones of depression are attributed to the increase in pumping from the aquifer for public and industrial supplies at Corinth and for rural supplies southwest of Corinth at Kossuth. Although records of water levels in observation wells may show an upward or downward long-term trend, water levels may be highly variable from year to year or from season to season. The two lower hydrographs presented in figure 3 show typical variations for wells completed in the Paleozoic aquifer (for locations, see fig. 2). For example, water levels in well G57 in Alcorn County had a general upward long-term trend and small yearly and seasonal fluctuations between 1978 and 1987. During the same period, water levels in well K11, located in Alcorn County in an area remote from pumping, had a downward longterm trend. Little yearly or seasonal fluctuation is apparent at this well because few measurements were available.

WATER-LEVEL CHANGES

Ripley aquifers

Water levels measured in wells in the downgradient part of the Ripley aquifers in 1987 ranged from 16 feet higher to 13 feet lower than water levels measured in 1978. Water levels in most wells completed in these aquifers in the northern part of the study area declined, whereas water levels in wells in or near the outcrop areas and in the southern part of the downdip areas rose slightly. Downgradient from the outcrop areas of the Ripley aquifers, water levels declined (from 1978 to 1987) at an average rate of about one-half foot per year. A probable cause for the larger than average declines (10 feet or more) is the influence from nearby pumped wells in the Ripley aquifers. Water levels in or near the outcrop areas have remained stable or have had small (less than 5 feet) recoveries. The largest waterlevel recovery (16 feet) was recorded in well F14 in Pontotoc County. The largest water-level decline (13 feet) was recorded in well D5 in Marshall County. All other recoveries and declines in the study area were less than 10 feet.

Paleozoic aquifer

Although long-term regional declines in water levels in wells in the Paleozoic aquifer occurred in several wells in Alcorn County between 1978 and 1987, substantial water-level recoveries also occurred in some wells in the county during this period. Between 1978 and 1987, the water level declined about 16 feet in well K11 located in southern Alcorn County, but rose about 34 feet in well G101 in the central part of the county. Recoveries in this area may be due primarily to a redistribution of pumping at Corinth--the largest pumping center withdrawing water from the Paleozoic aquifer in northeastern Mississippi. During this 9-year period, measured water levels in wells downgradient from the outcrop areas of the Paleozoic aquifer declined an average rate of about one-half foot per year.

Overall, 1987 water levels in wells completed in the Paleozoic aquifer in or near the outcrop areas and in a small area in central Alcorn County were higher than or about the same as 1978 water level. Increased recharge from precipitation, vertical leakage from the overlying Cretaceous aquifers, and a redistribution of pumping may have contributed to the higher water levels in these areas in 1987.

Boswell, E.H., 1963, Cretaceous aquifers of northeastern Mississippi: Mississippi Board of Water Commissioners

Boswell, E.H., Moore, G.K., MacCary, L.M., and others, 1965, Cretaceous aquifers in the Mississippi embayment: U.S. Geological Survey Professional Paper 448-C, p. 5-12. Darden, Daphne, 1984, Potentiometric map of the Paleozoic aquifer in northeastern Mississippi, November and December 1982: U.S. Geological Survey Water-Resources Investigations Report 83-4243, 1 sheet.

northeastern Mississippi, November and December 1982: U.S. Geological Survey Water-Resources Investigations Report 85-4041, 1 sheet.

Geological Survey Professional Paper 331-A, p. 18-22. Wasson, B.E., 1979, Potentiometric surface map of the Paleozoic aquifer in northeastern Mississippi, October and November 1978: U.S. Geological Survey Water-Resources Investigations Report 79-71, 1 sheet. --- 1980, Potentiometric surface map of the Ripley aquifers in

and Development Center, Jackson, Miss., 60 p.

freshwater at Corinth, until it was determined that the

In 1985, water use from the Paleozoic aquifer was

southwest, the direction of regional ground-water flow.

Ripley aquifers

Although pumping from the Ripley aquifers in the

REFERENCES

Bulletin 63-10, 202 p.

--- 1985, Potentiometric map of the Ripley aguifers in

Mellen, F.F., 1958, Cretaceous shelf sediments of Mississippi Mississippi State Geological Survey Bulletin 85, 112 p. Sohl, N.F., 1960, Archeogastropoda and stratigraphy of the Ripley, Owl Creek, and Prairie Bluff Formations: U.S.

northeastern Mississippi, October and November 1978: U.S. Geological Survey Water-Resources Investigations Report 79-1585, 1 sheet. --- 1986 (revised), Sources for water supplies in Mississippi: Mississippi Research and Development Center, Jackson,

Wasson, B.E., and Tharpe, E.J., 1975, Water for industrial development in Alcorn, Itawamba, Prentiss, and Tishomingo Counties, Mississippi: Mississippi Research

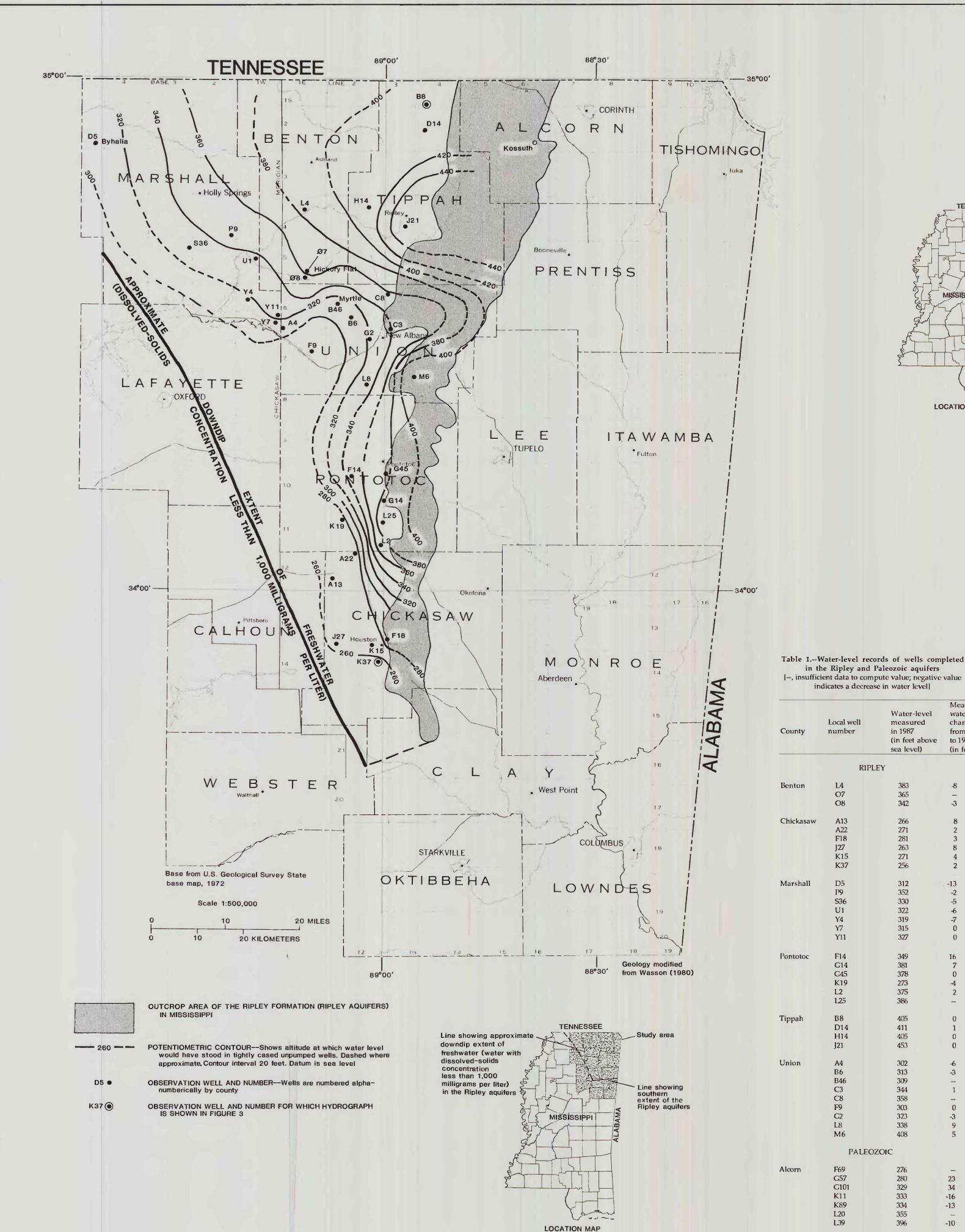


Figure 1.--Potentiometric surface of the Ripley aquifers, August through December 1987

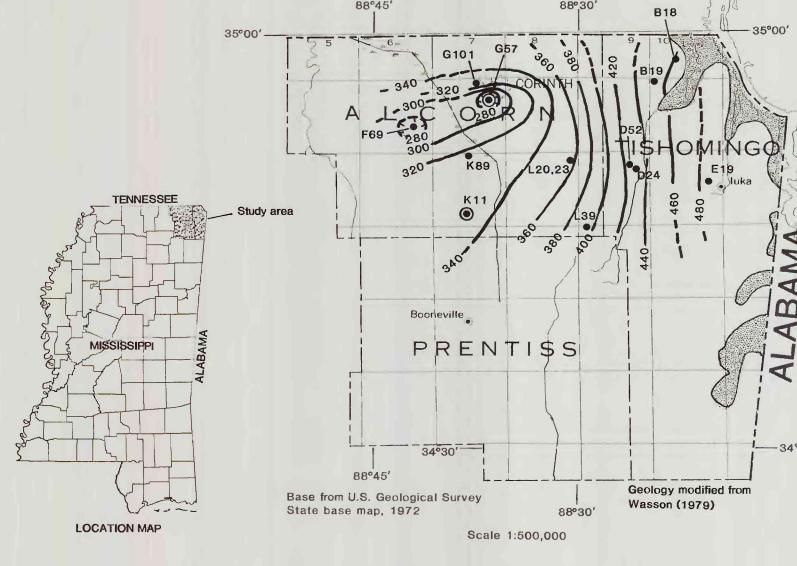
POTENTIOMETRIC-SURFACE MAPS OF THE RIPLEY AND THE PALEOZOIC AQUIFERS IN NORTHEASTERN MISSISSIPPI, AUGUST THROUGH DECEMBER 1987

Gala D.S. Goldsmith

1992

Ву

TENNESSEE



EXPLANATION

OUTCROP AREA OF THE PALEOZOIC ROCKS (PALEOZOIC AQUIFER) IN MISSISSIPPI

20 KILOMETERS

would have stood in tightly cased unpumped wells. Dashed where

20 MILES

approximate. Hachures indicate depressions. Contour interval 20 feet. Datum is sea level OBSERVATION WELL AND NUMBER--Wells are numbered alpha-

280 T POTENTIOMETRIC CONTOUR-Shows altitude at which water level

numerically by county OBSERVATION WELL AND NUMBER FOR WHICH HYDROGRAPH IS

Figure 2.--Potentiometric surface of the Paleozoic aquifer, August through December 1987.

SHOWN IN FIGURE 3

Water-level

(in feet above to 1987

measured

sea level)

in 1987

256

378

273

375

405

411

405

338

408

426

429

PALEOZOIC

RIPLEY

Local well

K15

K37

G45

D14

C101

K11 K89

L20

D24

D52

water-level

change

(in feet)

from 1978

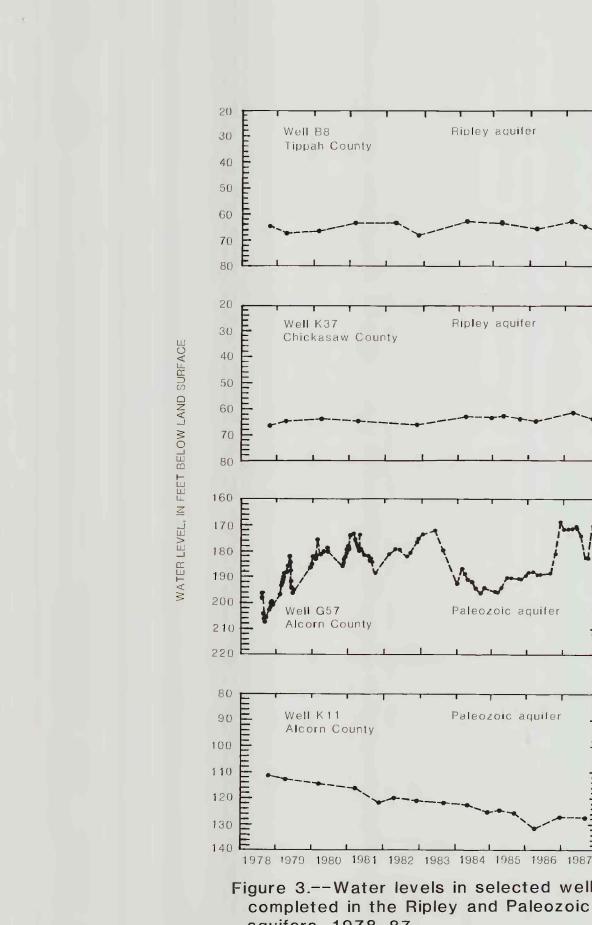
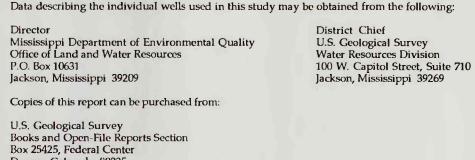


Figure 3.--Water levels in selected wells completed in the Ripley and Paleozoic aquifers, 1978-87.

ADDITIONAL INFORMATION



Denver, Colorado 80225 CONVERSION FACTORS AND VERTICAL DATUM:

To obtain 0.3048 mile 1.609 kilometer 2.590 square kilometer square mile million gallons per day 0.04381 cubic meter per second

Sea level: In this report "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)--a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929.

JACKSON, MISSISSIPPI